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THE EFFECTS OF MAGNETIC STORM PHASES ON F-LAYER IRREGULARITIES
FROM AURORAL TO EQUATORIAL LATITUDES

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As per recent request (December, 1989) we have initiated quarterly letter reports.

WORK IN PROGRESS

Operations in progress consist primarily of the the data reduction of radio scintillation records to be integrated with incoherent scatter radar parameters and optical observations. The data base is centered around the Boston area in order to obtain sub-auroral and auroral parameters. In turn these will be used in conjunction with available observations in the equatorial region to study the coupling between equatorial and high latitudes.

During the period March 7-18, 1989 we were able to make an interesting set of coordinated observations. This period included the sensational March 13-March 14 auroras which were observed optically as far south as Mexico. We are proceeding with reducing the Boston University optical measurements taken routinely under another program and the F-layer ionospheric irregularity data loaned to us by AFGL. Additional data will be supplied by British Antarctic Survey. Data reduction is almost complete. We have analyzed scintillation data from Ramey Air Force Base; the effects of the penetration of the electric field equatorwards was such that to the south of Puerto Rico there were "auroral effects" on radio transmissions from satellites. At AFGL Santimay Basu has reduced observations made from Hanscom AFB.

There is a good deal of interest in many groups located in the Boston area in the period. Millstone Hill personnel (Foster, Buonsanto et al) gearing up for continuous measurements of F region parameters, made an excellent study of ionospheric parameters for the period from March 7th to 10th (then they stopped). The Boston University optical measurements at Millstone Hill have some very interesting data particularly on March 9 (poor weather most of remaining nights in the period March 3-16th). The scintillation data has been reduced and a comparison is to be made of the instability conditions as indicated by the radar and the occurrence of intense small scale irregularities. The March 9 data are full all-sky optical images with a good deal of structure. The early part of the month contains quiet periods and the 15, 16, 17, 18 may contain data from recovery periods of the magnetic storms. On the night of March 13-14, there is limited optical data in the form of N-S meridian scans. Most of the March 13-14 data is saturated by the aurora that spanned all of our mid-latitude field of view ($L=2.5-4$). Radio and optical data will be studied to understand the dynamics of one of the great magnetic storms.

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CONTINUING STUDIES

A draft satisfactory from the point of view of Aarons for the period of the Equinox Transition Study as been sent to one of the co-authors, Alan Rodger of the British Antarctic Survey. The difficulty with this paper has been that the data set (the first time that incoherent scatter data in detail has been correlated with F-region irregularities over several magnetic storms) fails to satisfy the theoretical mechanisms for producing instabilities (which have never been subjected to rigorous observations). It is relatively easy to go along with accepted mechanisms but to challenge them requires great care (and probably problems with reviewers).

Other work in progress include a lead paper at the Ionospheric Effects Symposium on forecasting of F-layer irregularities and a paper on the effect of the ring current on sub-auroral and equatorial generation of patches of irregularities (using simultaneous observations for the first time).

PUBLICATIONS AND PRESENTATIONS

It is expected that the following invited review paper will appear in the March or April issue of the Proceedings of the IEEE in 1990

Goodman, J. and J. Aarons (1990) Ionospheric effects on modern electronic systems

Aarons and Mendillo attended the AGU Meeting in December 1989. Working on other programs, papers on equatorial and high latitude campaigns were presented by Mendillo and one graduate student. The graduate student, Peter Sultan, was the recipient of an outstanding student paper award for his presentation at the Fall Meeting of AGU.